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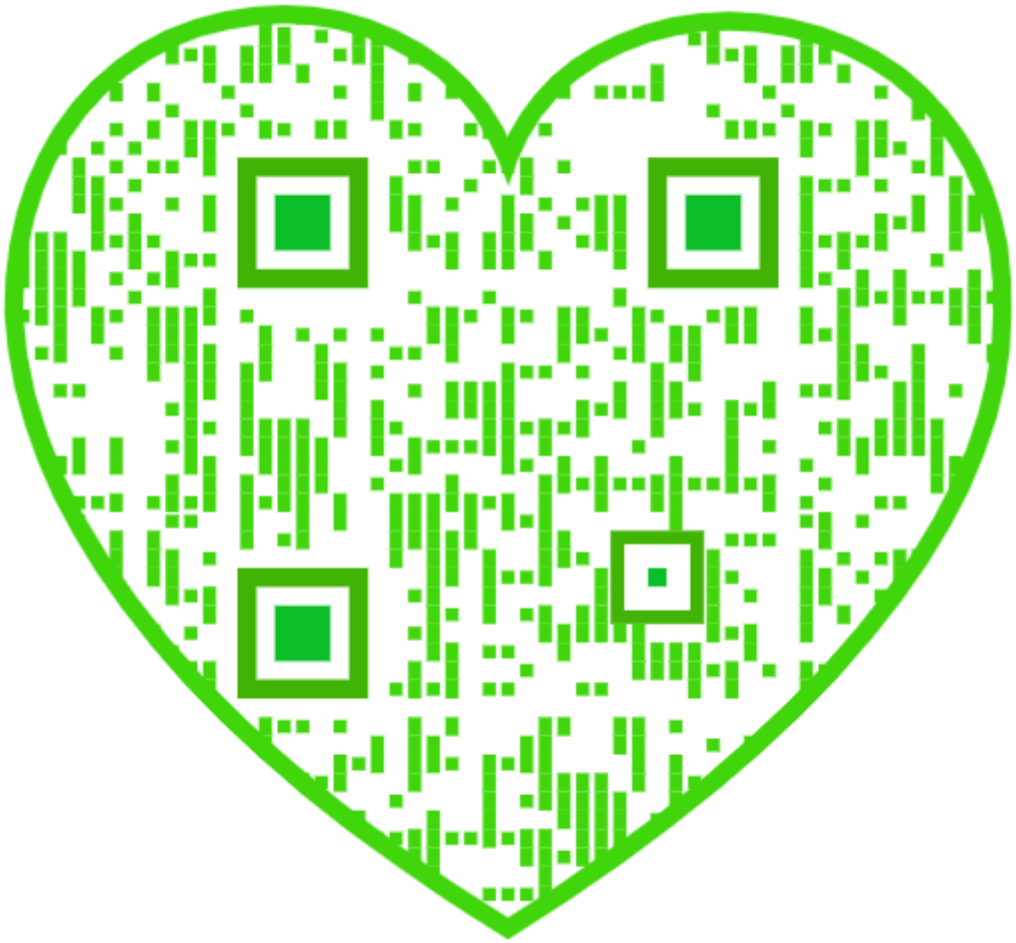

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Bulletin 264 March, 1916

Beekeeping in Wisconsin

N. E. AND L. V. FRANCE

HOME BUILDERS

This 250 colony apiary is run entirely for the production of comb honey.

AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF WISCONSIN

MADISON, WISCONSIN

DIGEST

Beekeeping returns the largest profit on the amount of money and labor invested, of any agricultural pursuit. Sometimes the return is as high as five dollars an hour for the time spent with the bees. A thorough knowledge of bees and honey production, however, is necessary before the most profitable results are possible. Pages 3 to 6.

Fruits and berries, besides many grasses and flowers, depend on the busy bee to distribute the pollen. A few bees kept near an orchard will not only prove profitable as producers of honey, but will also increase the profits of the orchard. Pages 6 to 7.

Soil and climate influence beekeeping. The length of the growing season often has an important bearing upon the number of kinds of plants producing nectar. On certain types of soil the best nectar producing plants do not thrive. Pages 7 to 9.

A constant supply of nectar from the honey plants is needed by the bees. If during a part of the summer season the bees cannot collect nectar, the profits are certain to be lowered. Pages 9 to 10.

The Italian bees are to be preferred as honey makers. Carnolian, Caucassian, and the common black German bees are other races which are not as desirable. Of the two varieties of Italian bees, the leather colored are generally preferred to the five banded or Golden Italians.
Pages 11 to 13.

To winter bees successfully is one of the essentials in beekeeping. Four essentials, sufficient and proper food supply, young fertile queens, plenty of young workers, and ample protection must be supplied.
Pages 13 to 16.

The amount of winter loss depends upon the amount of care taken by the beekeeper. A bee cellar, which is dry, dark, warm, and well ventilated will help keep the bees through the winter without loss, providing the colonies are properly prepared for wintering.
Pages 17 to 18.

There are several bee diseases known in Wisconsin. Paralysis, and sacbrood or pickled brood cause but slight damage. The American and European foul brood are the diseases which are of consequence. Proper care and management will greatly reduce the losses from disease.
Pages 21 to 27.

Beekeeping in Wisconsin

N. E. AND L. V. FRANCE*

The Business of Beekkeeping

For the amount of money invested and the labor involved, beekeeping gives as much, or more profit than any other agricultural pursuit. In this comparison, beekeepers, not "bee owners" are considered with dairymen, not "cow owners" and grain and stock farmers—not "soil diggers" and "stock drivers."

Among the minor agricultural industries of the state none are more important than beekeeping. The strength of this industry lies in the fact that a start can be made on a small capital and when the work is properly conducted the returns are tremendous. Strange as it may seem, only in one or two instances has this industry been exploited by capitalists, and yet those who have gone so far as to develop an organized business in the handling of bees, bee supplies and honey, report that many millions of dollars are turned over each year in this industry.

It is now about 18 years since N. E. France began his work as State Apiary Inspector and no greater tribute can he given him than to record the fact that thousands of the beekeepers of the state believe in him, and depend upon him for guidance. All these years he has worked steadily and unselfishly in the interests of Wisconsin beekeeping and beekeepers.

Much credit is also due his son, L. V. France, for valuable records now in the Department of Economic Entomology and which were secured and prepared under the supervision of J. G. Sanders, formerly in charge of this work at this Station. Fortunately, the Wisconsin Experiment Station is now in a position to continue the work already begun. Through the cooperation of the state authorities and the beekeepers themselves much good should be accomplished.—H. F. Wilson, Chief of Department of Economic Entomology.

The profits actually realized have been variously estimated by Wisconsin beekeepers as ranging from a fair return on the investment to as high as five dollars an hour for the time

*Through the courtesy of the Minnesota Experiment Station, Mr. L. V. France, Instructor in Beekeeping in the University of Minnesota, was permitted to cooperate with his father in the preparation of this text. Mr. France was assistant in Entomology in the Wisconsin Experiment Station in 1914–15.

spent in it. An authority of high standing has stated that eighty colonies of bees in a suitable locality and properly cared for will produce a revenue equal to that of the average 120 acre farm. However, like any other agricultural pursuit to be profitable, it must be conducted in a business-like manner and receive the same attention as the successful farmer or stockman gives to his crops or stock. Needless to say, a proper knowledge of bees and honey production is essential before the best results can be obtained.

About 90 per cent of those who start in bee culture fail because they do not have a sufficient knowledge of the life history and habits of the honey bee and modern methods of honey production. Or, possessing it, do not apply it properly. Commercial bee culture is a modern agricultural pursuit, the inventions and methods of management, making honey and wax production profitable, having been brought forward since 1850. Because of this and the general lack of scientific investigations, probably 80 per cent of the persons keeping bees are simply "bee owners" instead of real beekeepers. Practical "bee education" was never more needed in Wisconsin than at the present time as the industry is increasing with great rapidity. The State Inspector of Apiaries has found during his years of service in the state that a proper knowledge of bee and honey production applied for better beekeeping is more needed than is a knowledge of bee diseases.

BEES NEEDED TO DISTRIBUTE POLLEN

An abundance of honey bees is a safeguard to horticulture. They are the greatest factor in the distribution of pollen among fruits and berries. A few other insects carry pollen, but if all honey bees were removed during fruit bloom season, it is safe to say that there would not be enough fruit or berries produced to pay for the gathering of the crop. Wisconsin horticulturists producing annually thousands of dollars worth of fruit and berries recognize the value of bees as pollenizing agents and either keep bees in, or nearby their orchard, regardless of whether or not any honey is produced.

Fields of white and alsike clover seed within one mile of an apiary yield at least twice as much as do those where the

absence of bees is noted. A decreasing yield is found as the distance from the bees increases.

A FEW FIGURES ON BEEKEEPING

According to the 1900 United States Census there were on about 707,260 farms in the United States more than four million colonies of bees. These were valued at a little more than $12,000,000 and produced annually nearly 61,100,000 pounds of honey and 1,765,300 pounds of beeswax. The valuation of honey and wax was given at close to $6,000,000. These figures did not include bees kept in cities and towns

FIG. 1.—AN APIARY THAT "GREW"

The 75 colonies kept by this Wisconsin beeman produced less than 500 pounds of honey in a year. Their owner "follows" neither bee journals nor books.

where nearly as many colonies are found as on farms. Dr. E. F. Phillips of the Department of Agriculture has estimated the value of the average honey crop produced in the United States as at least $20,000,000 and the beeswax as $2,000,000. He regards these estimates as conservative.

Conditions similar to those in Wisconsin probably occur in other parts of the country. Here not more than one-tenth of the nectar produced is gathered and converted into honey by the bees, because there are too few bees present to gather it. In his recent book on beekeeping, Dr. Phillips

states "that not more than one-twentieth of the nectar secreted is saved." The value of honey bees in the United States as agents of fruit pollenizers will probably never be known, but it certainly could be placed at a high figure.

The 1910 Census Report lists, in round numbers, 95,000 colonies of bees in Wisconsin valued at $360,000. These are credited with an annual production of more than 2,150,000 pounds of honey and 55,000 pounds of beeswax, the valuation of which exceeded $235,000. As this enumeration did not include colonies kept in cities the total should have been at least 150,000. A very conservative estimate of the present

FIG. 2.—AN APIARY THAT WAS BUILT

The owner of this apiary lives but a short distance from that shown in Figure 1. His eight colonies increased to 32 the same year and produced in addition to that used at home, 1,240 pounds of honey. This beeman has read several books on bee culture and "follows" several bee journals.

annual honey production of our state would probably exceed 3,000,000 pounds.

ITALIAN QUEENS IMPORTED IN 1867

The history of beekeeping in Wisconsin has a close relationship to the development of bee culture in the United States. In 1867, Adam Grimm of Jefferson brought to Wisconsin from the eastern states the recently invented (1851) Langstroth movable frame hive with twenty Italian queens,

all that remained of a shipment of 100 queens from Europe. This was the first successful importation of queens on a large scale. Previous to the introduction of movable frames and Italian bees, bees were kept in hollow logs, boxes, straw hives or "skeps" where no opportunity was given to learn their life habits. With the introduction of modern hives, and Italian bees, many new inventions and better methods of handling were brought about. A better knowledge of the life habits of the bees was also gained which has made modern honey production profitable. Today Wisconsin has many progressive beekeepers producing tons of the best quality of honey found in the United States.

FLOWERING PLANTS WHICH PRODUCE NECTAR

A "honey plant" is a flowering plant producing nectar which is available to honey bees. A "honey flow" is the yield of nectar from one or more kinds of honey plants for the period in which the bloom yields nectar.

"Nectar secretion" depends on several conditions, some of which are not, as yet, understood. White and alsike clover require proper amounts of moisture with warm days and sultry nights to yield nectar most abundantly. The more important honey plants of Wisconsin named in the order they bloom are: dandelion (May 1 to June 1); white and alsike clover furnishing most of the surplus honey (June 1 to August 1), basswood or Linden (July 1 to July 20), sweet clover (July 15 to August 15), willow herb or fireweed, buckwheat, goldenrod, Spanish needle, asters, and many fall flowers in late summer and fall.

INFLUENCE OF CLIMATE AND SOIL ON BEEKEEPING

It is difficult to secure a good idea of the relation of the climate and soil conditions of a state to this poorly developed pursuit, for the larger number of persons engaged in it are usually following it only as a side line. For this reason, beekeeping has not been given the attention in Wisconsin that it deserves. Consequently, information gathered from beekeepers themselves is not entirely satisfactory.

Only general and distinctly marked influences of climate and soil are observed. These, however, do give general and roughly approximate data. We find that there are very few bees kept north of an imaginary line, running from Oconto, about 30 miles north of Green Bay, slightly northwest, through Antigo, Merrill, Ladysmith and through Burnett county to a point on the state line about 40 or 50 miles north of St. Paul. This is probably due in part to the unsettled condition of the region, but even more to the cold winters and comparatively short growing seasons for nectar-bearing plants.

Excepting near the Green Bay and on the Bayfield Peninsula where it may reach 140 days, less than 120 days is the usual length of the growing season north of that general line. The remainder of the state has a growing season of more than 120 days. In the eastern third of the state, the counties bordering Lake Michigan for a distance west of about 20 to 25 miles, have the growing season lengthened from 10 to 20 days. Likewise, the season for a strip, 15 miles wide, along the Mississippi River is lengthened from 10 to 15 days, but this is much less constant in the increased length of growing season than the eastern Wisconsin region.

Not only does the influence of Lake Michigan lengthen the growing season, but it holds back the advance of plant growth in the early spring, lessening danger from frost, and giving the bees when once started in the spring, a chance for uninterrupted brood-rearing. The dandelion and fruit bloom then close almost simultaneously with the beginning of clover bloom. This is important for in that region clover continues for about five weeks, and the basswood bloom begins about the third and fourth weeks in July. The season for clover and basswood is from one to two weeks earlier in the southern half of the remainder of the state, say from Juneau county south, but north of that county it is the same as is found in eastern Wisconsin.

SOIL TYPES AFFECT THE HONEY FLOW

The soils of the state also affect beekeeping by influencing the character of plant growth. So far as beekeeping is concerned, Wisconsin soils are of two kinds, heavy and sandy.

We find clover and basswood doing well on heavy clay soils and occurring less frequently on sandy soil. Much, however, depends on the character of the sandy soil.

If it is nearly all sand, usually few important honey-producing plants grow. Consequently, very few bees are found

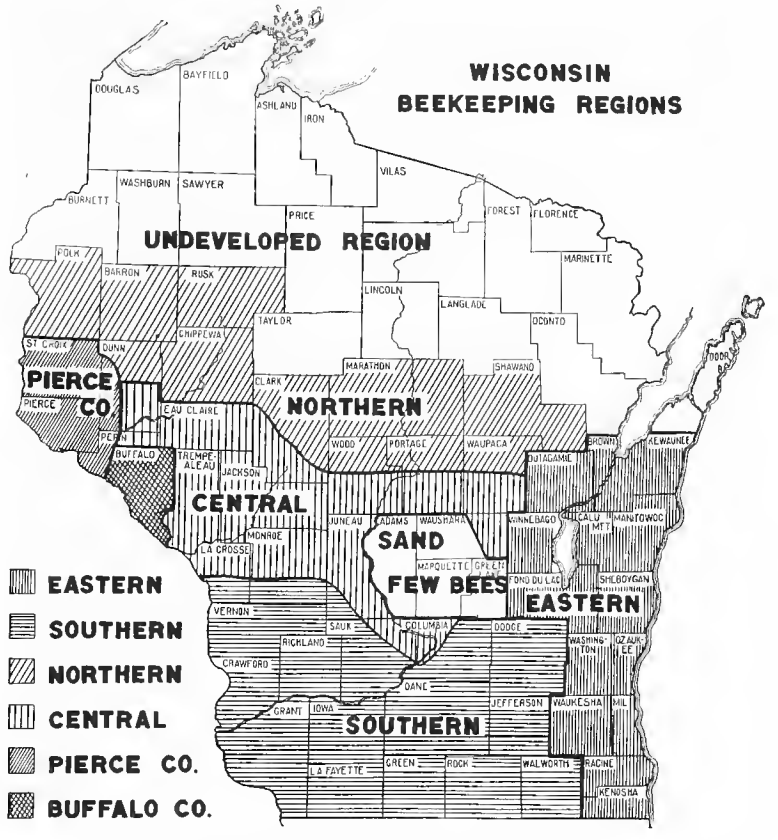

FIG. 3.—THE BEEKEEPING REGIONS OF WISCONSIN

Much of the state is well adapted, both from the standpoint of climate and soil to beekeeping. The industry is as yet quite undeveloped in the state.

in Waushara, Green Lake, Marquette and Adams counties. However, if the soil is a sandy loam, its value as furnishing bee pasturage varies with its content of sand. Upon the sandy loams in northern Sauk, southern Juneau, parts of Monroe, Jackson, Trempealeau, Eau Claire and Dunn counties there are certain areas fairly well adapted to beekeeping.

Generally outlined, such areas are the Reedsburg district in northern Sauk, Mauston in southern Juneau, Sparta in northwestern Monroe, Black River Falls and Merrillan in Jackson and most of Trempealeau, Augusta and Eau Claire southward in Eau Claire, and Menomonie in Dunn counties. On the other hand northern Juneau, parts of Monroe and Jackson counties are quite sandy and poorly adapted to beekeeping.

Almost enclosed within the sandy soil region is the majority of Buffalo county which is a residual clay and loessial soil. Here are numerous beekeepers especially about Mondovi and Alma. Then there is an area including Pierce, western Pepin, western Dunn and most of St. Croix counties, which is a clay soil giving good yields of white clover. This may be designated as the Pierce county district.

STATE DIVIDED INTO SIX BEE REGIONS

Climate and soil conditions, therefore, divide the present beekeeping part of Wisconsin into six regions. A considerable portion of the undeveloped section north of the northern region is fairly well adapted to beekeeping and awaits along with the progressive farmer, the beekeeper. In this region there probably are numerous localities that would yield good returns in honey from clover, basswood, goldenrod, and fall flowers. Wisconsin's climate, soils, and honey plants admirably adapt her for beekeeping so that with proper encouragement and development in near future she should rank with Texas, California and Colorado as a honey-producing state.

WHAT ARE ESSENTIALS FOR SUCCESS

Successful beekeeping means the ever-increasing happy life of service coming from the study and love of the wonderful honey bee and its reasonably profitable production of the best possible grades of pure honey and beeswax. The degree of success as a beekeeper is measured by his ability to understand and appreciate the life of the honey bee and to properly fit into the conditions of climate and plant growth which concern him in his region or locality.

THE DIFFERENT TYPES OF BEES

Honey bees are not natives of America. They probably were first brought over by the Spaniards, as "common bees" and were first reported in Florida in 1763. Making their homes in hollow trees, they moved north and westward gradually, but in advance of settlers. The Indians called them the "White man's fly." They became distributed over the United States east of the Mississippi River by the time of the first known importation of bees from England, Germany and Italy.

Soon after the close of the Civil War, Italian bees from northern Italy began to be imported. The first successful importation was made in 1868 by Adam Grimm of Jefferson, Wisconsin. As beekeeping developed, the common black angry bees became more or less mixed with the yellow gentle Italian bees. Even today in the different states there are few localities having "pure" common, black German bees; they are mostly hybrids or crosses of blacks and Italians, the amount of Italian blood depending largely upon the attention given to his bees by the individual beekeeper.

Carniolan and Caucasian bees are the only later imported races of bees that possess enough desirable characteristics to be of practical interest. The black bees are a trifle smaller than the Italian or Carniolan bees, but are hardy, and if a plentiful supply of good food is present will withstand well the cold winters and climatic changes. They are easily angered, will sting upon the slightest disturbance and are non-resistant to the wax moth and European foul-brood disease. The queens are quite prolific and noted for brood rearing.

ITALIAN BEES BEST HONEY GATHERERS

The Italian bees have three or more yellow bands on the abdomen, are often slightly larger than the black bees, but as a rule are not quite as hardy. As a race they are more gentle, are strongly resistant to the wax moth, and much less liable to European foul brood. Their queens are very prolific.

There are two varieties of Italian bees—leather colored and five banded or Golden Italians. Of late years the former are more generally preferred as honey gatherers and because they possess greater resistance to European foul-brood. The Carniolan bees are gray, whereas the Italian bees are yellow, very hardy, working in the field longer than other races of bees, are gentle, resist wax moths well and the queens are extremely prolific. They are noted for abundance of swarming. The Caucasian bees are dark colored, but not as black as the common black or German bee. They are noted for glueing up hive and frames with beeglue or propolis and sec-

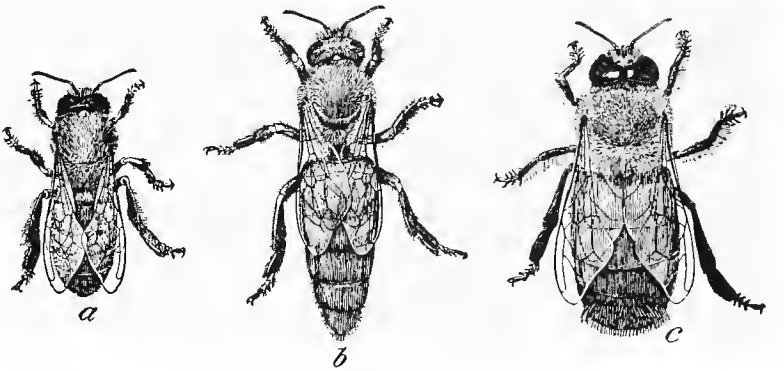

FIG. 4.—THE HONEY BEE FAMILY

Every normal colony of honey bees is made of three classes: (a) workers; (b) the queen; and (c) drones.

tions of comb honey require much cleaning so that at present compared with the Italians they seem an undesirable race of bees.

THE DIFFERENT MEMBERS OF A COLONY

A normal colony of bees during the summer is composed of one queen, many thousand workers, and several hundred drones. The queen bee is the only perfectly developed female bee, she being practically an egg laying machine capable of laying from a few daily, in the spring and fall, to over 2,000 daily during the height of the brood rearing season. She has little if anything to do with the government of the colony, but is the most essential individual for its existence, and it has been truthfully stated that about the queen hinges all

there is in the management of bees. The worker bees are undeveloped females, incapable of laying fertile eggs. They do all of the required work as gathering nectar, pollen, propolis, water, also feed and nurse young bees, build comb, clean house, and guard the hive from intruders. The sting or mandibles are used for defense as occasion requires. The drone is the male bee. He does no work and his existence is for the sole purpose of mating with the queen which takes place while they are in flight.

SOME ESSENTIALS IN BEE MANAGEMENT

In late summer and fall.—Whether or not bees winter well depends, in no small degree, upon how well they are managed in the late summer and fall. Essential wintering conditions that can be controlled by late summer and fall management are the winter food supply, the presence of young fertile queens, and plenty of young workers.

The securing of a crop of honey from late summer and fall flowers is not general throughout Wisconsin. It is confined mostly to localities having in sufficient quantities special occurrences of one or more of these plants; buckwheat, sweet clover, goldenrod, "fire weed" or willow herb, blue and white asters, wild sunflowers and related swamp and lowland plants. Under our conditions, however, very little surplus honey is obtained, as a rule, from these sources. Probably sweet clover, goldenrod and asters yield the most fall surplus when any is secured.

CHOOSE WINTER BEE FOOD CAREFULLY

For winter food, combs of two-thirds capped-over clover or basswood honey is, without question, the best. Often, however, this honey supply has been removed for sale and insufficient amounts of other good honeys have been secured by the bees. If an excess of buckwheat honey, or honey from fall flowers, is present in the hives, the bees do not usually winter as well as when they have less than one-half of their stores of that undesirable type of honey. If the bees have gathered, in the late summer and fall, quantities of honey dew from plant lice and exudations of plants, a very heavy

winter loss is almost certain to result. Sometimes from 50 to 75 per cent of the colonies wintered on such food die before the first of March, largely from dysentery.

When large amounts of undesirable food are present, the successful beekeeper will remove most of it in the late fall and feed the colonies according to their needs for winter, corresponding quantities of either good honey or some kind of good sugar syrup. Sugar syrup for late feeding should be made by boiling for a few minutes two parts of sugar with one of water by measure. To aid in preventing the sugar from crystallizing in the combs three-fourths of an ounce of tartaric acid should be added to each 50 pounds of sugar used. The syrup should be fed while warm, preferably above the bees in large feeders and in as large quantities as possible until a sufficient amount is stored. For an average colony wintered in the cellar, from 25 to 30 pounds of actual food should be available. For colonies wintered out-of-doors 30 to 40 pounds of actual stores is necessary.

COLONIES NEED YOUNG FERTILE QUEENS

Young fertile queens are practically necessary for successful wintering of bees. The late summer and early fall is the correct time for the successful beekeeper to manage his colonies in such a way that each one will have a fertile queen reared the same or the previous season. Where a fairly good flow of honey is obtainable from sweet clover, goldenrod or early fall flowers, a good method for raising queens in late summer is to feed the desired queen-rearing colony each evening a small amount in addition to the natural honey flow. This will cause the colony to become exceptionally strong and incite the bees to raise a considerable number of fine large, well nourished queen cells. When these have been capped and may be expected to hatch, in three or four days, divide the two or three strongest colonies in the bee yard into three and four frame groups. Give to each a capped queen cell and to prevent robbing, be certain that the entrances to them are as small as convenient. When these queens are laying, they may be introduced into the desired colonies.

The remaining essential for successful wintering of bees, controlled by late summer and fall management, is that there

be plenty of young worker bees. This factor is of more importance than is usually supposed. Very often colonies, having plenty of good food with an old fertile queen, come out of the cellar with plenty of bees, but in two or three weeks dwindle down to a mere handful. This is due largely to the fact that old bees constitute the colony in the fall. They naturally die of old age shortly after passing through the winter and for this reason the value of the presence of plenty of young worker bees in the fall is evident. When the beekeeper has reason to believe that most of the bees in his colonies are old and there is no prospect of a fall flow of honey, it is advisable to feed, beginning with the first of September, a little honey or sugar syrup every two or three days in order to stimulate the queen so that plenty of young bees will be obtained for winter. This should be done only when there is a sufficient quantity of food for winter already present. If there is not sufficient food for winter and feeding is desirable for the production of young bees, larger quantities of food will be required according to the respective needs of the colonies as the bees must store away their winter's food supply at the same time.

AVOID EARLY STIMULATIVE FEEDING

There is one point which should be carefully observed, however, and that is not to begin this stimulative feeding too early. When it is begun by the middle of August the queen often receives a very strong permanent stimulus so that the colony continues to raise a large amount of brood until the last of September or first week in October, and thereby consumes a large part of their winter stores. Of course, a very large number of fine young bees are thus obtained for wintering, but this is likely to result disastrously because an insufficient amount of food is left for winter. Usually a sufficient number of young worker bees are obtained when stimulative feeding is begun September 1. With that management, practically all of the young bees are produced from the stimulative food given them and the winter stores remain to be used when most needed.

In winter months.—The wintering of bees is to be understood as their maintenance from the beginning of settled cold

weather in late fall to the proper time for their removal from the cellar in early spring, or if wintered out-doors, to the time for the appearance of the first natural pollen. In Wisconsin, this period will usually be from March 20 to April 15.

Winter loss is a term applied to the bees that die from the time that settled cold weather begins to the time for the appearance of the first natural pollen in the spring. Nearly all Wisconsin bees are wintered in cellars. Of 186 Wisconsin beekeepers reporting in October, 1914, to the State Apiary

FIG. 5.—AN IDEAL BEE CELLAR

These colonies are well protected from cold, well supplied with pure air and shielded from light. This cellar is dug in a solid sand rock bluff.

Inspector, 160 or 86 per cent wintered their bees in cellars, 21 or 11.8 per cent wintered their bees out-doors, and only five, or two per cent used special repositories and packed apiary-houses.

FACTORS IN SUCCESSFUL WINTERING

There are four main essentials that must be provided for successful wintering of bees. The first three factors, sufficient and proper food supply, young fertile queens, and plenty of

young worker bees, have already been considered. In out-door wintering several methods are used to provide the desired protection. One method is to wrap the hives in heavy paper. As insufficient protection is usually given the bees against our cold and changeable weather, more Wisconsin beemen who winter their colonies out-of-doors might well follow this plan.

Probably the most common method of wintering bees out-doors in Wisconsin is to enclose a single hive in a box or "winter case" large enough to permit two or three inches of packing to be placed around and over the hive. Sometimes these winter cases are made large enough for each to accommodate two or four colonies. Sometimes colonies are arranged in long rows in tenement sheds of permanently or temporarily constructed side walls and roof. Suitable packing is then placed over and about the hives. Double walled hives are also used for out-door wintering, but only to a limited extent in Wisconsin.

MANY BEES WINTERED IN CELLAR

When bees are wintered in the cellar, the cellar itself is the protection against the winter weather. Successful cellar wintering of bees resolves itself into the observance and maintenance of proper bee-cellar conditions. The cellar must maintain a fairly constant temperature, not high or low, 42 degrees F. to 48 degrees F. being generally considered the most practical temperature; it must be well ventilated with pure air, naturally through the floor, ceiling, and walls, or artifically with ventilating tubes; it must also be dry and it must be dark. A bee-cellar which possesses these conditions, provided naturally or artifically for the entire winter will always winter bees with absolutely no loss providing the colonies are properly prepared for wintering.

WINTER LOSS CAN BE CONTROLLED

Winter loss is due to the partial or total absence of one or more of the essential requisites for successful wintering. The amount or extent of winter loss is absolutely under the control of the beekeeper. The winter loss in Wisconsin for 1892-

1893 was 70 per cent; for 1911-1912, 30 per cent; for 1912-1913, 10 per cent; for 1913-1914, 8 per cent and for the past five years the average has been 15 per cent. There has been an apparent decrease in the winter loss in the last few years and it is to be hoped that an increasing number of Wisconsin beekeepers are providing more and better wintering conditions for their bees each succeeding year. This probably will be tested within the next five or six years when we may expect the severe winter that appears once in every ten or twenty years. At that time "beekeepers" will be distin-

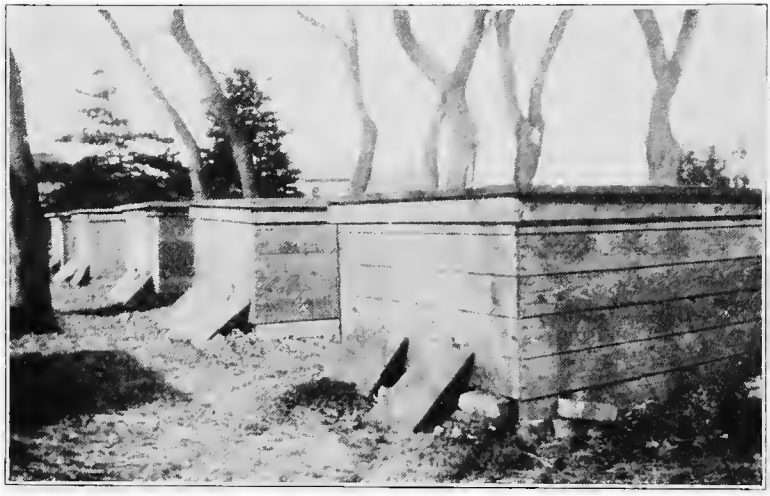

FIG. 6.—FOUR-COLONY WINTERING CASES

These are built on the same principle as the double-walled single colony hives.

guished from "keepers of bees" by their possession, in the following spring of a large percentage of live colonies instead of empty hives. The extent and seriousness of winter loss will always remain a problem to be solved by the individual beekeeper as no locality presents sufficient factors to establish general wintering conditions.

During summer season.—Most Wisconsin honey is made during five to eight weeks of the summer months, the season often beginning in the southern counties as early as June 10. For this reason, in many localities, if surplus honey is obtained at all, it must be secured during a period of three

to five weeks. The colonies should be managed throughout the year so as to have the largest possible working force in each colony at the beginning of the main honey flow in order that the maximum amount of honey may be made. In general then, spring management largely consists of building up the colonies suffering from winter losses.

Summer management alone consists in so handling the colonies as to encourage honey production and hive increase. For comb honey production it is necessary to create pressure in the hive so as to force the bees up into the small unnatural

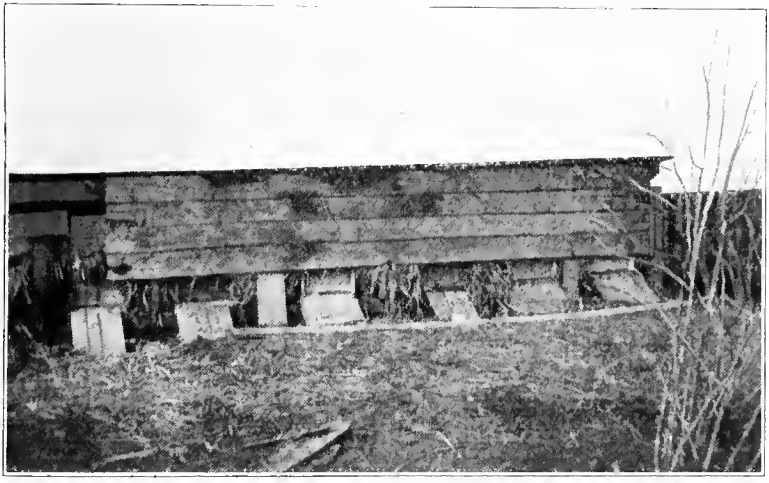

FIG. 7.—WINTER QUARTERS FROM SIDE WALL AND ROOF
Colonies may be arranged in long rows and covered by tenement sheds.

square compartments in which the comb honey is stored. This pressure is gained by keeping the main hive practically filled with combs containing brood and honey so that nearly all of the freshly gathered nectar will have to be stored in the supers above.

WHEN THE BEES ARE READY TO SWARM

As a result of the crowded condition in the hives, swarming often results and this forms one of the chief troubles of the comb honey man. Swarming can be prevented to a certain extent by the removal of queen cells, proper manipu-

lation of the brood combs, giving the queen more room in which to lay eggs and proper addition of supers for honey storage.

Care, however, should be taken so as not to provide too much room at one time, otherwise the bees will not fill the sections properly. Partly filled and unfinished comb honey sections are practically worthless.

In most of Wisconsin, dandelion and fruit bloom give sufficient stimulation so that the bees are about ready to swarm at the beginning of clover bloom in early June. At that time, remove all queen cells and the two outside honey laden combs in the brood chamber of the hive, also spread out the other combs and insert two empty frames containing full sheets of brood comb foundation. Then put on one super of sections containing full sheets of foundation and use separators or fences between the sections. When the sections are two-thirds full of honey, raise the first super and slip a second between it and the hive body. Continue this process throughout the season and to prevent from being travel stained remove filled supers as soon as the sections are filled and capped. Manipulate the brood chamber part of the hive as occasion demands.

A beekkeeper can often be distinguished from an "owner of bees" by properly marketing only the best grades of honey, feeding back to his bees the unfinished sections. In producing extracted honey the "pressure" needed for comb honey is unnecessary as the regular large sized combs are used instead of sections. It being natural for bees to store honey in as large combs as possible, they apparently lose less time in storing honey in combs than in sections. Much time is also saved to the bees because the large combs are emptied of honey in the extractor and returned uninjured to be refilled, instead of being sold with the honey. Thus, two to three times as much liquid honey may be secured as comb honey.

MANAGING HIVES TO INCREASE HONEY PRODUCTION

When clover begins to bloom, the colonies should be relieved of "pressure" and if all started queen cells and three or four combs from brood chamber are removed and replaced

with frames containing full sheets of comb foundation alternated with the remaining brood combs, the desire to swarm will be greatly decreased. It may be further decreased by the addition of a hive body of surplus combs. Following this manipulation, place a wood and wire queen excluder between the brood and extracting super to prevent the queen from laying in the extracting combs.

Extract the honey from upper combs as soon as they become one-half to two-thirds capped over, or when the uncapped honey is not thin like water. In the latter case, it may be extracted or placed with additional combs in another hive body. Additional supers and combs should be added as needed and room given in the brood-chamber by the removal of more brood as seems advisable, replacing the frames taken out with wired frames containing full sheets of comb foundation. The combs of brood and honey removed should be used to aid weak colonies or in making increase. Always extract "ripe honey" and properly market the best possible grade that can be produced.

A very common way to make increase, is to let each colony swarm once; hive the swarm in a new hive on empty combs or frames with full sheets of foundation, and then give the old hive a new queen. Before introducing the new queen, however, destroy all queen cells or if desirable to let the bees requeen themselves do not add the queen and leave one queen cell to develop. A better way, and one which avoids the trouble of catching swarms, is to use the brood combs taken from colonies during the process of "room-making," place six or eight of these, usually made up of capped brood, in a new hive with a peck of bees stolen from some exceedingly strong colony and give them a ripe queen cell with which to develop a new queen. This method should only be used during honey flow. Another way to increase the number of colonies without the trouble of swarming is to divide a strong colony at the beginning of honey flow, letting the queenless part raise a queen from the best ripe cell that can be found.

DISEASE MAY CONSUME BEEMAN'S PROFITS

The presence or absence of bee diseases in a beeyard often means the difference between a profit or loss as applied to

the crop of honey for any particular year, as well as the destruction of the combs should the disease be American foul brood. The inconvenience and trouble of treating to get rid of disease is considerable, sometimes sufficient to discourage the beekeeper, especially when the disease treated, reappears for a year or two following the treatment. Again a beekeeper may successfully treat his bees, absolutely freeing them of any disease only to have them become inoculated again the same or following year from diseased bees of a neighbor even two or more miles away. If foul brood appears when bees are neglected or run on the let-alone-plan, it is quite certain that no honey will be obtained the first year and every colony will die of disease in two years. American foul brood and possibly European foul brood is carried in combs and honey from diseased colonies, and from such material whether sold in the market or even moved to new localities, the disease may be carried and spread broadcast by visiting bees.

BEE DISEASES FOUND IN WISCONSIN

Bee diseases known to appear in Wisconsin are: paralysis, sacbrood, or the so-called pickled brood, and American and European foul brood. Paralysis and sacbrood do not cause extensive damage in Wisconsin beekeeping while American and European foul brood are quite extensively distributed, and are of great consequence. Both are infectious.

Because of the practical impossibility of observing the life history and habits of bees housed in boxes, "skeps" and log gums during the early days of beekeeping, there is some doubt as to the exact time of the first appearance of bee disease in Wisconsin. We find no record of diseased bees in Wisconsin till after the introduction and use of movable frame hives, nor is it known when or how the first foul brood was brought into Wisconsin.

During the marked successes of Mr. Grimm in the "70's," probably about 1877, American foul brood appeared among his bees. From 1880 to 1885 it appeared in apiaries in many other sections of the state when a rather extensive and rapid interchange of bees, hives and combs was going on. It was a very easy thing for diseases to spread broadcast over the state at that time because of the ignorance of its presence and

the rapid and extensive sale of and interchange of queens and bees, especially of the newly introduced Italian race which is credited with a portion of the rapid spread of foul brood. At that time queens were usually shipped with a small piece of comb containing some honey, these pieces being the carrying agents of foul brood. Thus, whenever queens were sold from an affected apiary, they were probably quite effective in spreading the disease.

AMERICAN AND EUROPEAN FOUL BROOD

About 1890, the seriousness of the foul brood situation became apparent, many beekeepers in various parts of the state rapidly losing their bees. Frequently the bees died with plenty of honey in the hives and conditions became so bad that it was evident that some serious trouble existed among the colonies. About that time information reached Wisconsin regarding the presence of bee diseases in Ontario, Canada, and in the eastern United States. It was soon found that the cause of much of the loss among bees here was due to foul brood of the American type. The result of this was the passage of a foul brood law by the Wisconsin Legislature which became effective in 1898. The senior author of this bulletin was appointed Foul Brood Inspector and has been reappointed successively so that 1915 made his seventeenth year of continuous service.

Previous to 1907, the foul brood observed in Wisconsin was of the type now known as American foul brood. This same year a new disease occurred at Portage which proved to be what is now known as European foul brood. Since this appearance of European foul brood the records of the Inspector show that it was present at Portage in 1908, 1909, and 1911 and that the same disease appeared at Elkhorn in Walworth county in 1909; Mauston in Juneau county; Ellsworth and Spring Valley in Pierce county; and Ashland in Ashland county, 1911; Darien in Walworth county, and West De Pere, in Brown county, 1912; Lyndon in Juneau county; Forest Junction in Calumet county; Verona in Dane county; Maiden Rock, Bay City, Beldenville in Pierce county in 1913; and Milwaukee and West Allis in Milwaukee county; Two Rivers in Manitowoc county; Green Bay in Brown county; Kaukauna in Outagamie county; Rock Elm, Elm-

wood, Plum City, Spring Valley, in Pierce county in 1914.

During the years that the disease was found at Portage, the best possible care and treatment was given each case so that the occurrence at this one place indicates that the

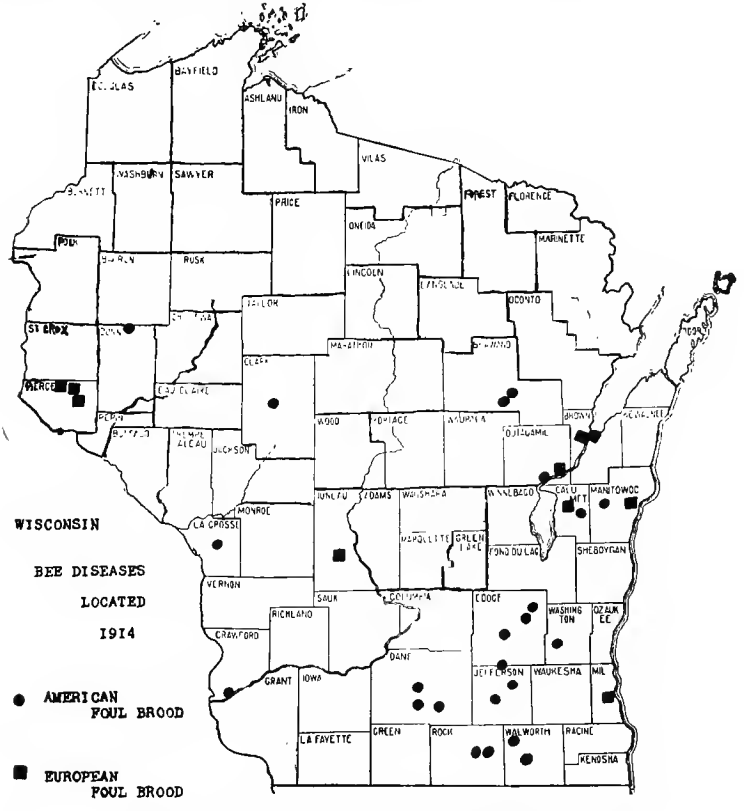

FIG. 8.—APPEARANCE OF FOUL BROOD IN 1914

These diseases are easily spread in a number of different ways. Fortunately, the seriousness of the situation is being appreciated by more and more beekeepers.

disease is exceedingly difficult of control and eradication. At present there is no indication of European foul brood at Portage and there has been none since 1911.

THE PRESENT FOUL BROOD SITUATION

At Greenwood in Clark county 12 to 15 years ago there were 1,000 colonies of bees where at present there are but

10 colonies. The destruction of the basswood timber in that locality is partly responsible for this condition, but the presence of bee diseases, allowed to continue almost without any consideration, is the principal cause. On many farms there were from 50 to 250 colonies of bees, now only an occasional farmer having 4 to 30 colonies may be found, and in the Greenwood region itself there probably are not more

FIG. 9.—DISEASE MEANS WASTE

In two years American foul brood killed 120 colonies which had been producing annually 12,500 pounds of extracted honey.

than four parties owning individually as high as 100 colonies. As in previous years, the disease appeared again in 1913 and 1914, but it is under absolute control and will probably be eradicated the coming season.

In an old log house at Greenwood there were stored the remains of about 300 colonies of bees. These colonies died with American foul brood eight years ago. The following spring the hives and combs containing about 1,000 pounds of honey were simply piled one above the other in this open log house, where bees, both domesticated and wild, were

robbing the diseased combs and carrying the honey to the beeyards of nearby beekeepers.

There are throughout the state, especially in eastern and northeastern Wisconsin, many who usually keep only a few colonies of bees, seldom over twenty-five. Too many manage their bees according to methods in use 20 or more years ago and pay little attention to foul brood until it kills practically all of their bees. Often this disaster does not seem sufficient to bring about better beekeeping for not infrequently foul brood combs, if not actually filled with foul brood material, are saved and used again. Sometimes it does not seem sufficient for a beekeeper to let his own bees die of foul brood, but with no thought of others, he leaves the affected combs exposed so that his neighbors' bees may get at the diseased combs and carry the infection to the home colony. A fact, which is difficult to understand is the absolute disregard of the rights and privileges of other beekeepers which some "owners of bees" and certain beekeepers seem to have.

It is fortunate that the number of such beekeepers is rapidly decreasing. There are only a limited number of persons who at first either refuse to treat their bees for foul brood or do so under protest. At present, better control and more immediate prospects of eradication of bee diseases exists in the state than ever before. This is partly due to the increased appropriation for apiary inspection made by the laws of 1913. Through this legislative action, more and better inspection was provided for in the diseased localities so that not only increased control but eradication of both American and European foul brood is taking place. In practically all diseased localities in Wisconsin, foul brood is largely under control and it seems that continued proper and persistent inspection will soon free the state of bee diseases.

WHAT OF THE FUTURE?

Early dairying in Wisconsin was poorly organized and advanced slowly. Immediately following the invention of the Babcock butter fat test (1890), a great stimulus was given to the industry. Increased recognition was given to

dairying by the Agricultural College and Experiment Station. This, with favoring soil and climate has advanced dairying very rapidly in the state.

At present the condition of beekeeping is comparable to that of dairying previous to 1890 as there are a number of America's extensive honey producers in Wisconsin. Wisconsin annually produces about 1,500 tons of choice honey, but the beekeeping industry has not advanced to the point of recognition as a distinct specialized branch of agriculture. Although much of the undeveloped land in Wisconsin

FIG. 10.—DISEASE WAS FORCED OUT

This Fond du Lac county apiarist cured her 185 colonies of the disease and last year had for sale 7,382 pounds of comb honey and 4,750 pounds of extracted honey.

and most of the present cultivated land is not now occupied as bee pasture, a majority of it offers opportunity for excellent bee "locations."

As general farming, stock farming, dairying, and horticulture advance in all parts of the state, beekeeping will develop accordingly, materially aiding pastures and clovers especially. At the same time abundant honey crops will be secured and beekeeping will assume its proper place as an agricultural industry. Beekeeping thus promises to fit in admirably with agriculture something like an additional strengthening spoke in a great wheel.

Future Wisconsin beekeeping can easily be expected to produce many tons of the best grades of honey and thus save nature's most healthful sweet. A pound of honey is about equal in food value to a pound of sirloin steak, which costs much more. This food is now going to waste for lack of enough bees to gather it. The possibilities of beekeeping as a most fascinating means of gaining a living are increasing every year. Wisconsin offers almost ideal conditions in climate, soil, honey plants and is adjacent to the rapidly developing honey markets so that beekeeping should prove one of Wisconsin's greatest minor industries.

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